



# **METOC MISSION PLANNING TOOLS**

**LCDR Ray Chartier Jr  
"Black Cloud"**

**MPUC FEB03**

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MISSION SUCCESS



# Overview

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- ◆ **Navy OAG top 10 - METOC related**
- ◆ **How far have METOC TDAs come since last year?**
  - **TAWS** (Target Acquisition Weapons Software)
  - **AREPS** (Advance Refractive Effects Prediction System)
  - **OPARS / NFWB** (Optimum Path Aircraft Routing System / Naval Flight Wx Briefer)
  - **TAM** (Target Area Meteorology)
- ◆ **What's next?**
  - **JMPS initiatives**
  - **Your Requirements**

# **Navy MP OAG 02**

## **TOP 10 Requirements**

- ◆ **#6 Improve sensor performance prediction tools that account for environmental effects and seamlessly integrate into current and future mission planning and rehearsal systems.**
  - **TAWS / AREPS <---> PFPS and JMPS**



# **NAVMPS OAG TOP 10 Requirements**

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- ◆ **# 7 Develop execution simulation tools with route rehearsal that effectively integrates with the mission planning system and existing Navy and Marine Corps simulation development to include debriefing capability.**

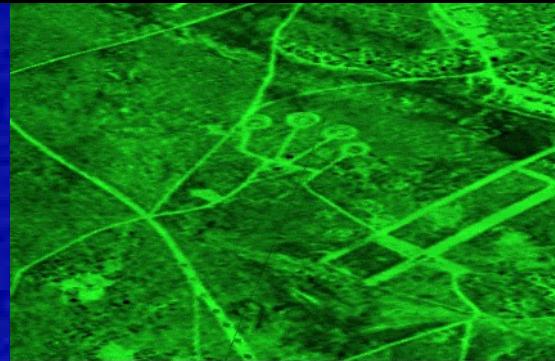
- **TAWS / IRTSS / OPARS / NFWB <--->  
TopScene & FalconView and JMPS**

# IRTSS In-flight Comparisons

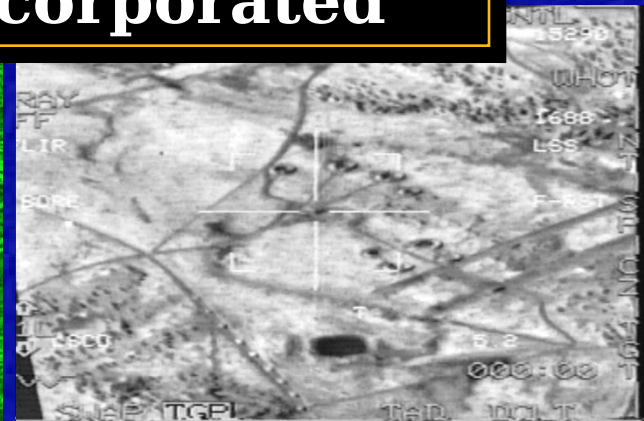
Mission rehearsal simulation  
Sensor viewing / detection range  
information / weather and  
environmental effects incorporated



**IR Black Hot**



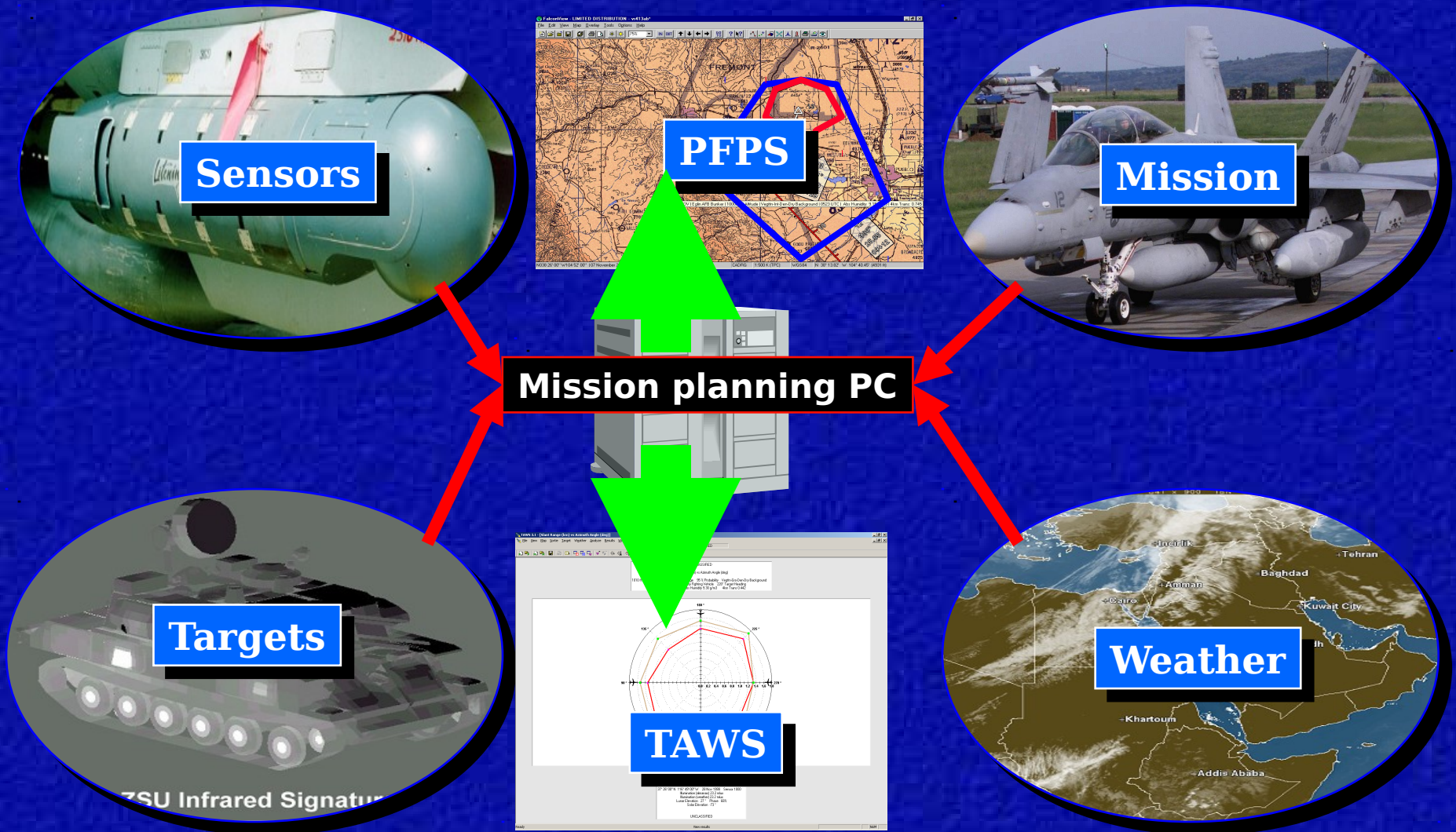
**IR White Hot**



**Litening Pod Video**

Currently a AFRL project  
-21Feb02 will be installed Nellis AFB to  
support  
Red Flag and Weapon school

# Target Acquisition Weapons Software (TAWS) Structure





# **TAWS: What is it? What can it do for me?**

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**Mission planning tool to optimize  
attack effectiveness while  
minimizing threat exposure**

**Integrates: OPS**

**Target / Target background  
Environment parameters**

**Produces: TDA - attack  
effectiveness options**

**Battlespace / Target area SA**

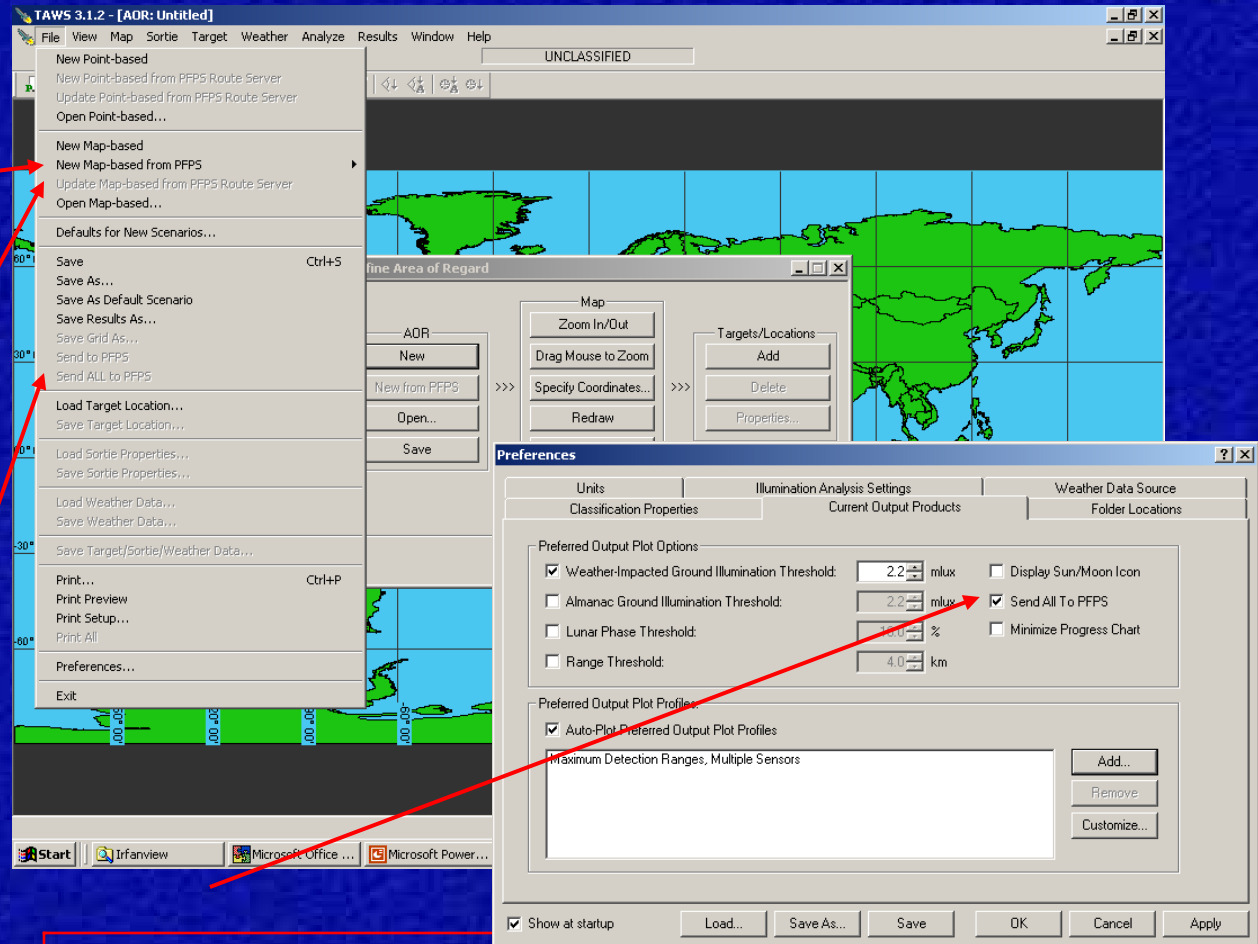


# Improvements to Interface with PFPS

Option to initialize a TAWS sortie from the currently focused PFPS route or a CRD file.

Option to update the active TAWS scenario from the currently focused PFPS route.

Options to send one or all available "by-view-direction" graphs to FalconView in a single step.



Automatically send all available "by-view-direction" graphs to FalconView.

# TDA Mission Planning

Combat Flight Planning Software - [vr413ab]

File Premission Edit Search Turnpoint Route View Window Help

TAWS Meteorological Data

Turn Pt	Type	Fix/Point	Latitude	Elev	Aspd
DTD		Description	Longitude	MV	Bank
		KBRK/R253039	VW105 28.000	10.3E	
4		VR413 C	N 38 29.000	unk	480G
		KHBU/E074055	VW105 52.000	10.5E	
5		VR413 D	N 38 18.000	unk	480G
		KHBU			
6		VR41			
		KAL3			
7		VR41			
		KAL3			
8		VR41			
		KAL3			
9		VR41			
		KAL3			
10		VR41			
		KPUE			
11		VR41			
		KPUE			
12	IP	RWE			
		IRTS			
13	TG	RWV			
		AIRC			
14	TG	RW9			
		MVC			
15	TG	RW9			
		SE C			
16	TG	RW9			
		SKIP			
17	IP	BKF			

FalconView - LIMITED DISTRIBUTION - vr413ab\*

File Edit View Map Overlay Tools Options Help

75% IN OUT

Surface Weather Data

Atmospheric Temperatures ... 12 to 24 °C

Sea Surface Temperature ... 21 to 21 °C

Cloud Information

High Level Clouds ... 0 to 2 Eighths

Mid Level Clouds ... 0 to 0 Eighths

Low Level Clouds ... 0 to 0 Eighths

of BL to 15 Km)

-4 to -4 °C

50.0 to 50.0 km

Tropospheric

OK Cancel

NFOV | Egin AFB Bunker | 10000' Altitude | Vegtn-Int-Den-Dry Background | 0523 UTC | Abs Humidity: 9.15 | 13.14km Trans: 0.745

N038 26' 00" W 104 52' 00" | 07 November 2001 | Sensor ID 1004

CADRG | 1:500 K (TPC) | WGS84 | N 38° 13.82' W 104° 40.45' (4931 ft)

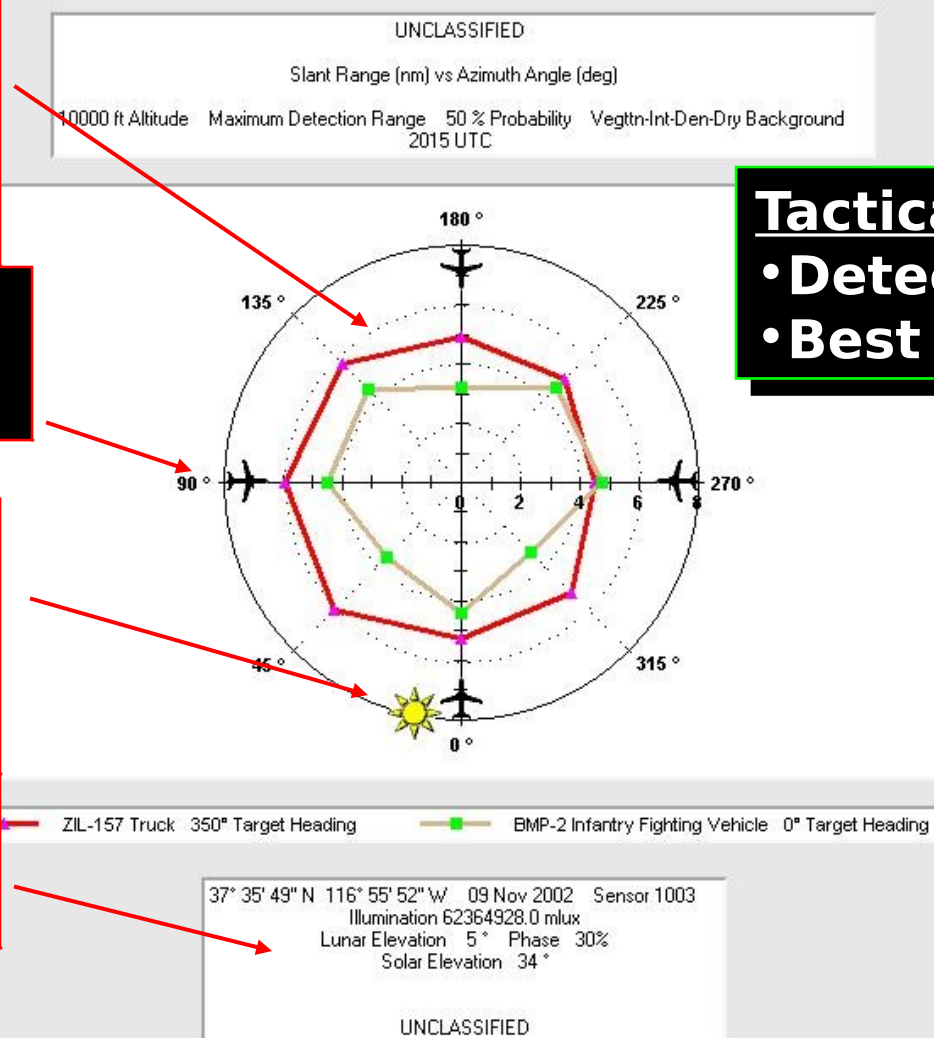
# More Flexible Graphic Output Products

**Plot results from multiple targets and/or sensors on a single graph.**

**Aircraft icons stress that graph is target-centric.**

**Sun/moon icons show azimuth angle of illumination source..**

**Legend includes specific solar/lunar info..**



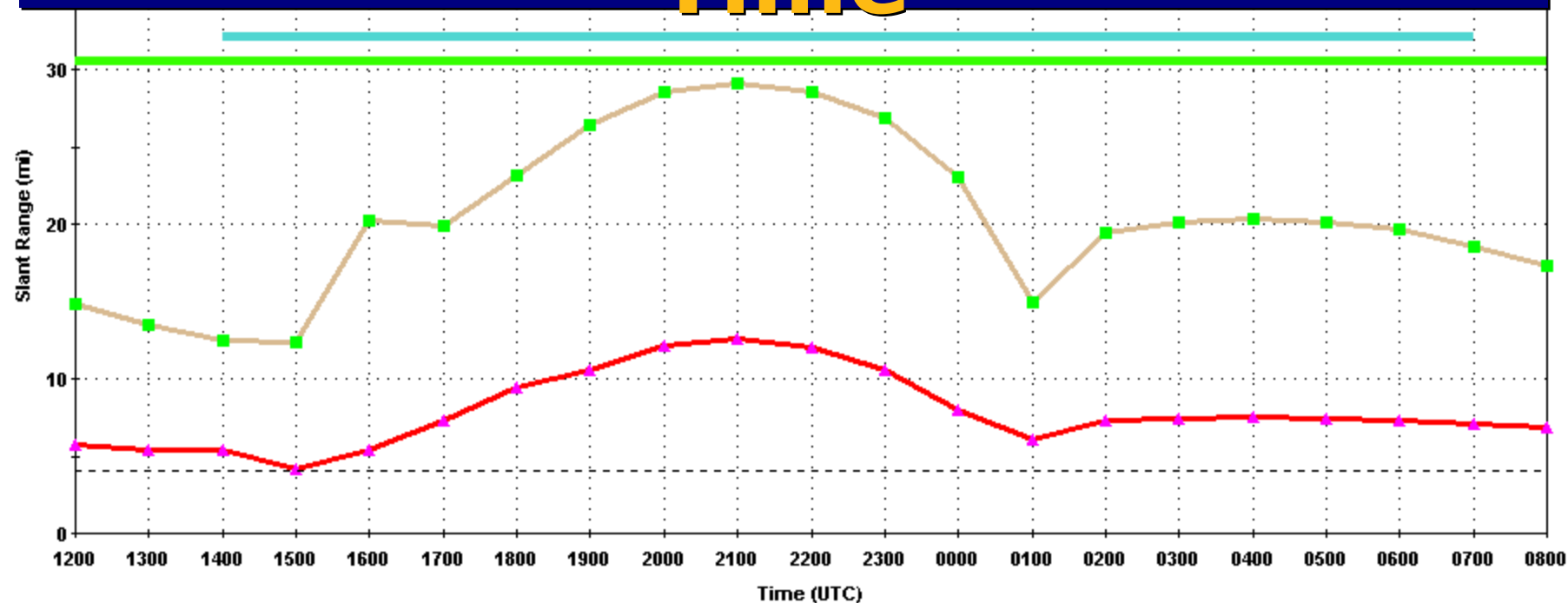
## Tactical Tools

- Detection range
- Best attack axis



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Slant Range (mi) vs Time (UTC)  
15000 ft Altitude Maximum Detection Range 50 % Probability Soil-Ave-Dry-Dry Background  
215° Sensor View Direction T-80 U/B Tank 0° Target Heading

# Detection (slant) Range Vs Time

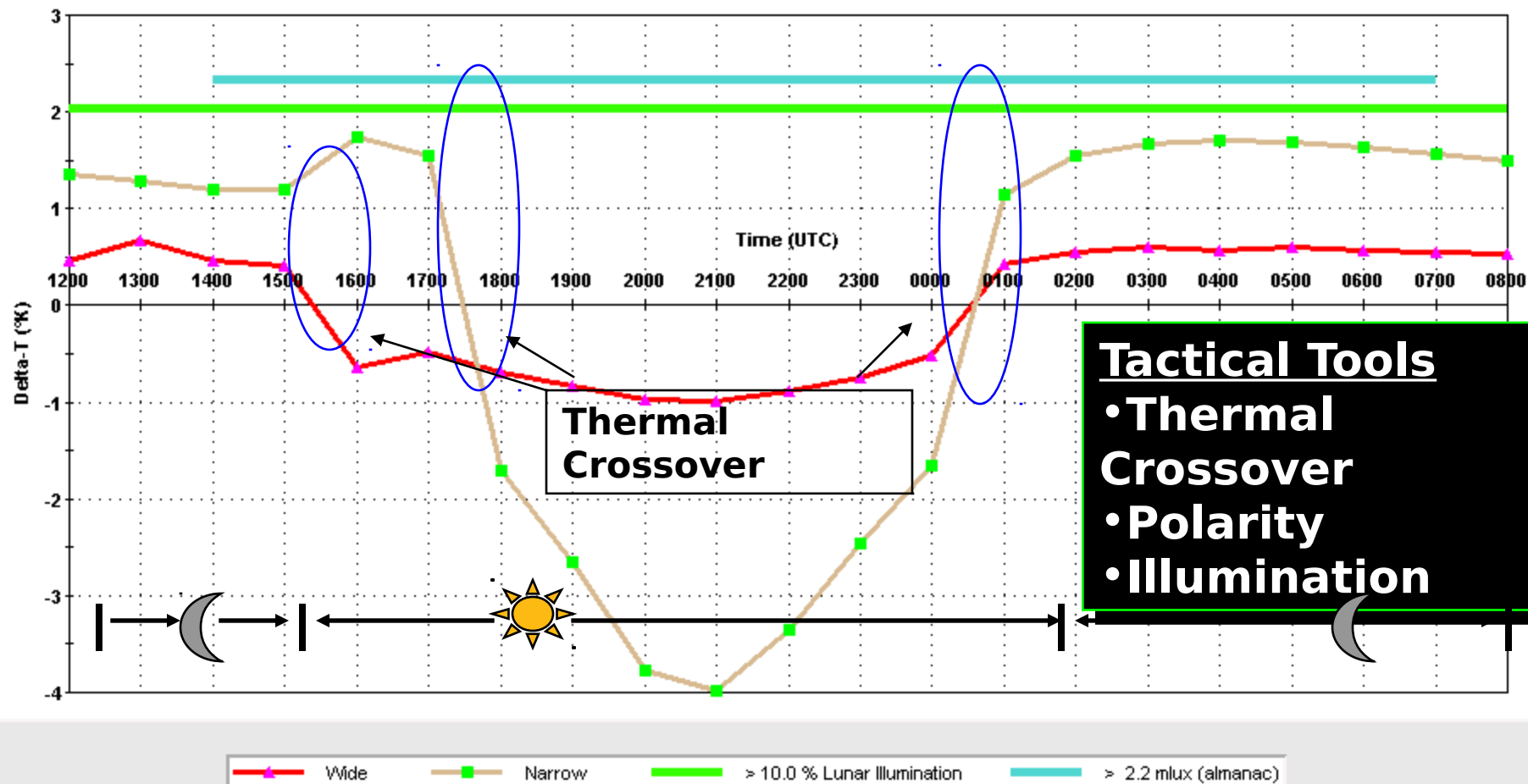


Wide Narrow  $\geq 10.0\%$  Lunar Illumination  $\geq 2.2$  mlux (almanac)

39° 14' 00" N 118° 20' 00" W 07 Feb 2003  
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# Thermal crossover times (Delta T Vs Time)

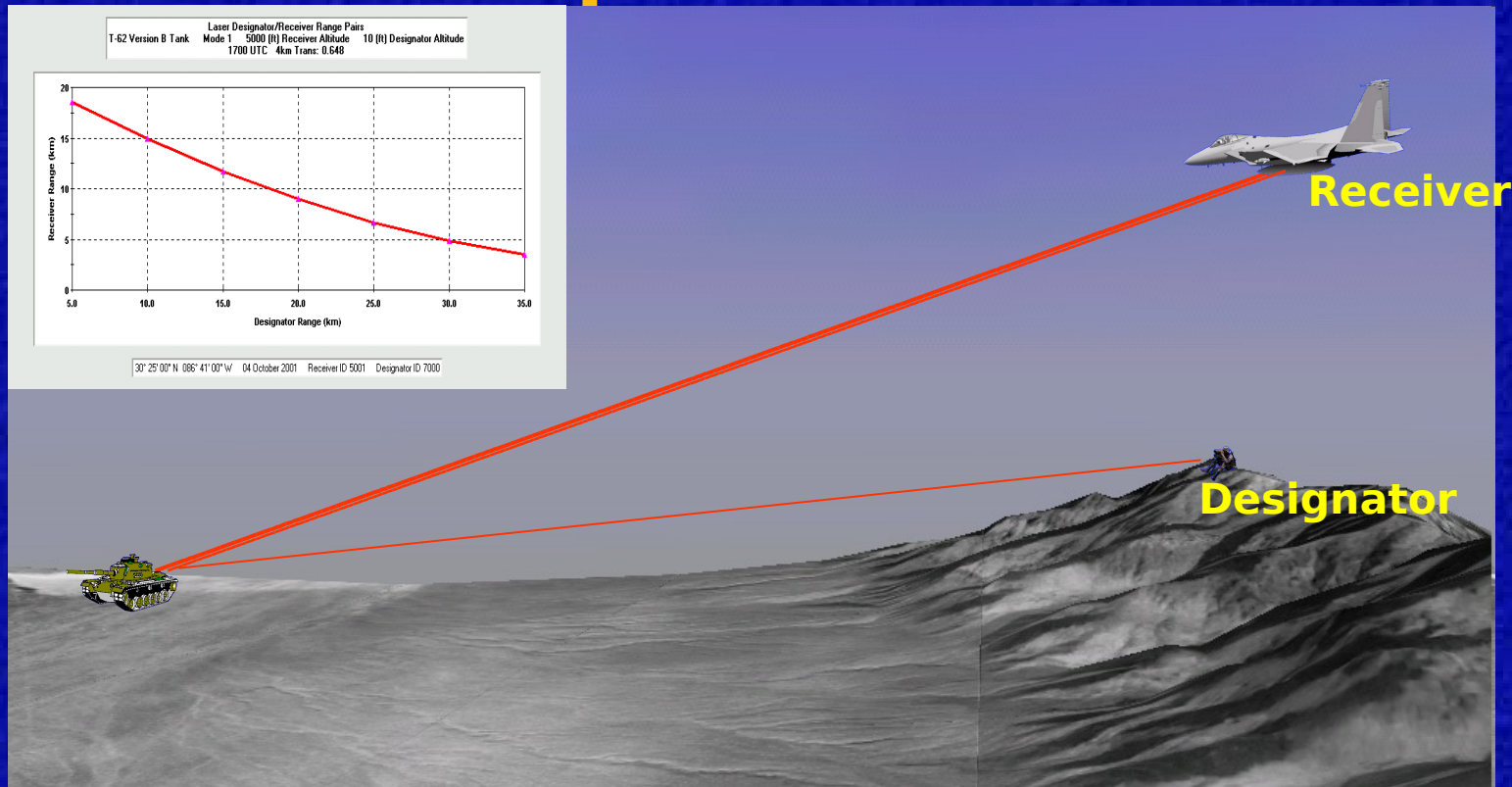
Delta-T (°K) vs Time (UTC)  
 15000 ft Altitude Maximum Detection Range 50 % Probability Soil-Ave-Dry-Dry Background  
 215° Sensor View Direction T-80 U/B Tank 0° Target Heading



**Tactical Tools**

- Thermal Crossover
- Polarity
- Illumination

# TAWS Laser Detection Range product



Here we have a Special Forces troop on a 10,000 ft mountain top designating a T-62 tank in the valley below. The laser receiver is on the aircraft at 15,000 ft AGL. The TAWS output shows the possible designator and receiver range combinations.



# JMEM Terminology

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- ◆ “Detection”
  - Object is sighted
    - FLIR has seen thermal contrast
- ◆ “Recognition”
  - Object belongs to a class (vehicle)
- ◆ “Identification”
  - Object belongs to a subclass (tank)
- ◆ **TAWS gives detection range not recognition or identification**

# **TopGun's ROT for TAWS**

## **◆ 60 - 70 % of TAWS**

**Detection range = target  
Recognition Range**

- Ex  $15.1\text{nm} \times .6 = 9.06\text{nm}$**
- A/G Transition point - 15nm**
  - Radar OAP**
- FLIR handoff - 9nm**

# Does it work?

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- ◆ **OA divisions on CV(N) support strikes with TAWS**
- ◆ **Over 700 TAWS packages CY02 supporting 9 CVW Fallon DETs, SFTI courses and SFARP**
- ◆ **Pilot comments:**
  - **Changed attack heading, altitude, TOT?**
  - **Increased SA A-A -> A-G timing**
  - **Increased SA with sensor performance**
  - **Accurate (SLAM-ER, Hellfire, LGB etc)**



# **MPUC 02/03 Limitations**

- ◆ **No** Recognition range output (V3.1)
  - Version 3.2 if you make it a requirement
  - Now probability of detection
- ◆ **No** target building (Target editing)
  - Iraq target priority list in the works
  - JAWS categories
  - Increased METOC / INTEL connection
- ◆ **Yes** seamlessly integrated with MPS
- ◆ **No** terrain shadowing (DTED)
  - Version 3.2 if you make it a requirement

This is the top view. Slide 2 is the view from the

The Red is the terrain  
masking for the radar

SA-6 Battery

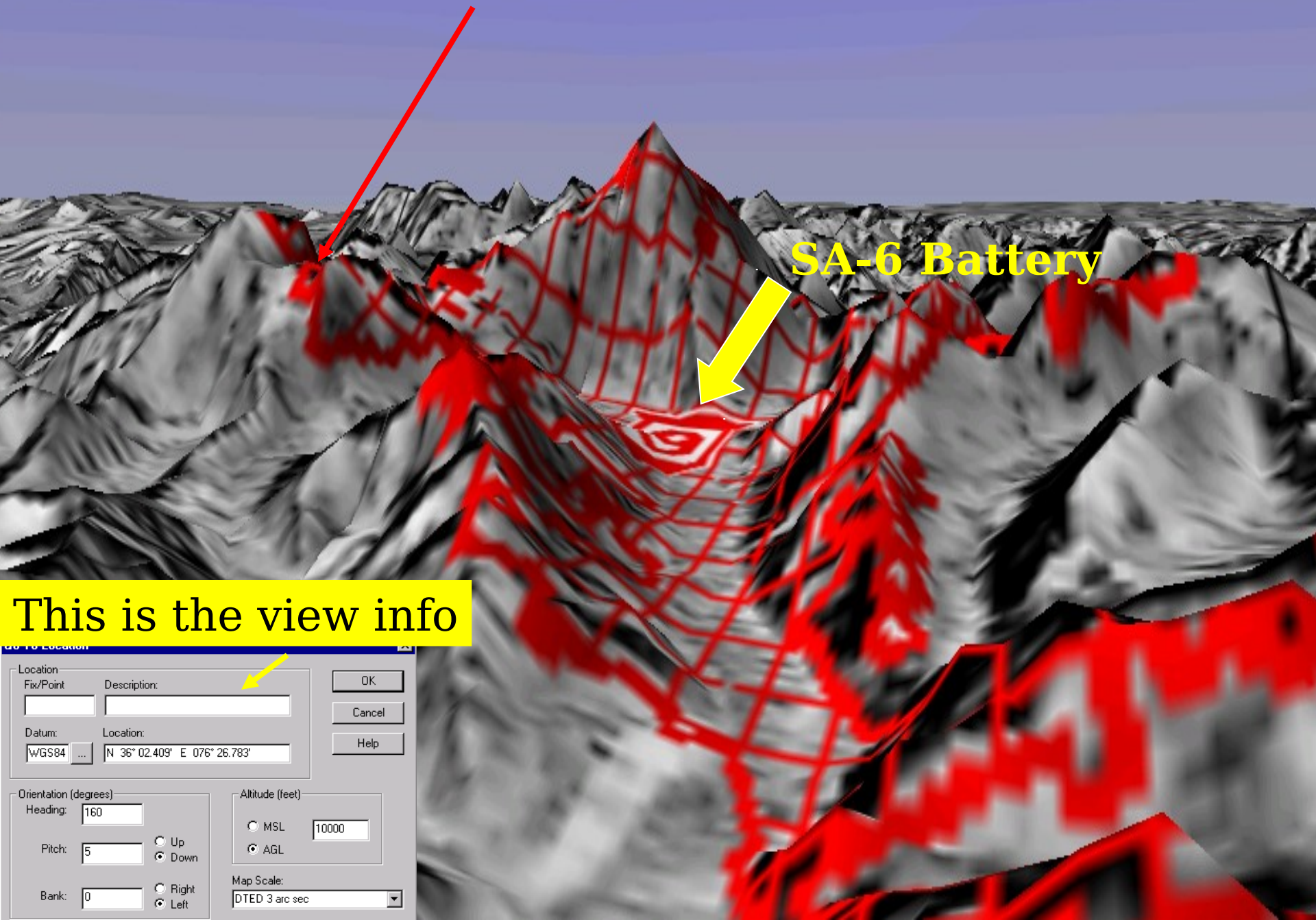
**Action: Need this capability  
in TAWS**

This is K2 the 2<sup>nd</sup> highest  
Mountain the world.  
28,250 ft



**The Red is the terrain masking for the radar.**

GNYSCTD Schofield, US



**SA-6 Battery**

**This is the view info**

Go To Location

Location:	
Fix/Point	Description:
<input type="text"/>	<input type="text"/>
Datum:	Location:
[WGS84] ...	N 36° 02.409' E 076° 26.783'
<input type="button" value="OK"/>	
<input type="button" value="Cancel"/>	
<input type="button" value="Help"/>	

Orientation (degrees)	
Heading:	<input type="text" value="160"/>
Pitch:	<input type="text" value="5"/>
Bank:	<input type="text" value="0"/>
	<input type="radio"/> Up
	<input checked="" type="radio"/> Down
	<input type="radio"/> Right
	<input checked="" type="radio"/> Left

Altitude (feet)	
<input type="radio"/> MSL	<input type="text" value="10000"/>
<input checked="" type="radio"/> AGL	

Map Scale:

DTED 3 arc sec



# TAWS Version 3.1.2 Features

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## ◆ **Targets / Backgrounds**

- Navy's improved water background model for MWIR/LWIR
- Additional targets in the TAWS target database

## ◆ **Sensors**

- Army's ACQUIRE sensor performance model for IR/TV/NVG detection ranges and detection probabilities
- Additional sensors in the TAWS sensor database

## ◆ **Meteorological Data**

- Automated ingest of COAMPS weather data from the Navy's TEDS
- More efficient regional weather download from TEDS

## ◆ **Geographic Data**

- Ability to initialize background and albedo from Army TEC's high-resolution terrain features database
- Ability to determine target shadowing and target masking from Army TEC's high-resolution terrain elevations database. \*\* Version 4 (Spring04) Need DTEDS\*\*

# TAWS Version 3.1.2 Features (cont.)

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## ◆ Usability Enhancements

- Merge NOWS capabilities into TAWS
- Allow separate saves for weather, sortie, Intel input components
- Copy across function for weather parameters
- Startup location is the last location used
- Flexible graphs
- Preferred output products automatically appear when analysis is done
- Preferred file locations
- Classified or unclassified processing
- Toolbar buttons for all major steps
- Context-sensitive help available with right mouse click

## ◆ Interface to PFPS 3.2

- Load sortie / Intel information from PFPS route server or CRD file
- Automatically send output to FalconView map server

## ◆ Miscellaneous

- New Illumination Quick Look option
- New Analyze over Grid option
- DII/COE Level 6 compliant
- NMCI Certified

# Planned Version 4 Upgrades

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## ◆ Targets / Backgrounds

- Use JAWS target categories and subcategories
- Allow target editing (change overall dimensions, paint color)
- Support wakes for ship/boat targets
- Support airborne targets for the IR/Laser (Apache/Kiowa)
- Additional targets in the TAWS target database

## ◆ Sensors

- Support recognition / identification ranges and probabilities
- Support TV CCD sensors
- Support near-IR pointer (Laser marker) Lightning 2 Pod
- Additional sensors in the TAWS sensor database

## ◆ Atmospheric Transmission

- Allow upward and near-horizontal LOS paths for the IR/Laser
- Implement multi-layer transmission model

# Planned Version 4 Upgrades (cont.)

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- ◆ **Meteorological Data**
  - Download temperature profile from TEDS
- ◆ **Interface to PFPS**
  - Support PFPS additional points (Desired Impact Points, Offset Target Points, and Offset Aim Points)
- ◆ **Usability Enhancements**
  - Port TAWS GUI to Java to support non-Windows platforms
  - Update the GUI look-ad-feel to correspond to the NITEDS II OOR
  - Interface to JMTK maps
  - Allow more flexible output tables
  - Support for target masking and shadowing using DTED
  - Support vulnerability predictions for target-based NVGs



# AREPS

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## Advanced Refractive Effects Prediction System



Provide an operational and research capability to compute and display EM system propagation effects over water, across coastlines, and over varying terrain, including range-dependent refractive effects, for land-based, sea-based, and airborne systems.



# AREPS 3.0 New Features

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- **User interface**

- Single toolbar for all windows
- Quick-start buttons
- Step-by-step help

Enhanced popup menu flex  
Change options on-the-fly

- **FalconView interface**

- Output to FalconView display / Save as FalconView draw files
- Reads FalconView threat files
- Reads various Electronic Order of Battle data files

- **Ground-wave HF communications**

- Currently only propagation loss
- FY03 - Skywave, specific system thresholding, numerous dis

- **COAMPS/MM5 forecast data ingest**

- METOC center's DAMPS homepages
- Joint Army Air Force Weather Information Network

- **Automode**

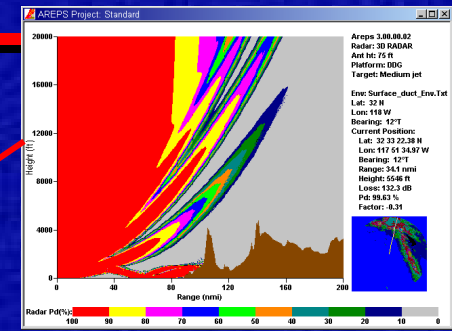
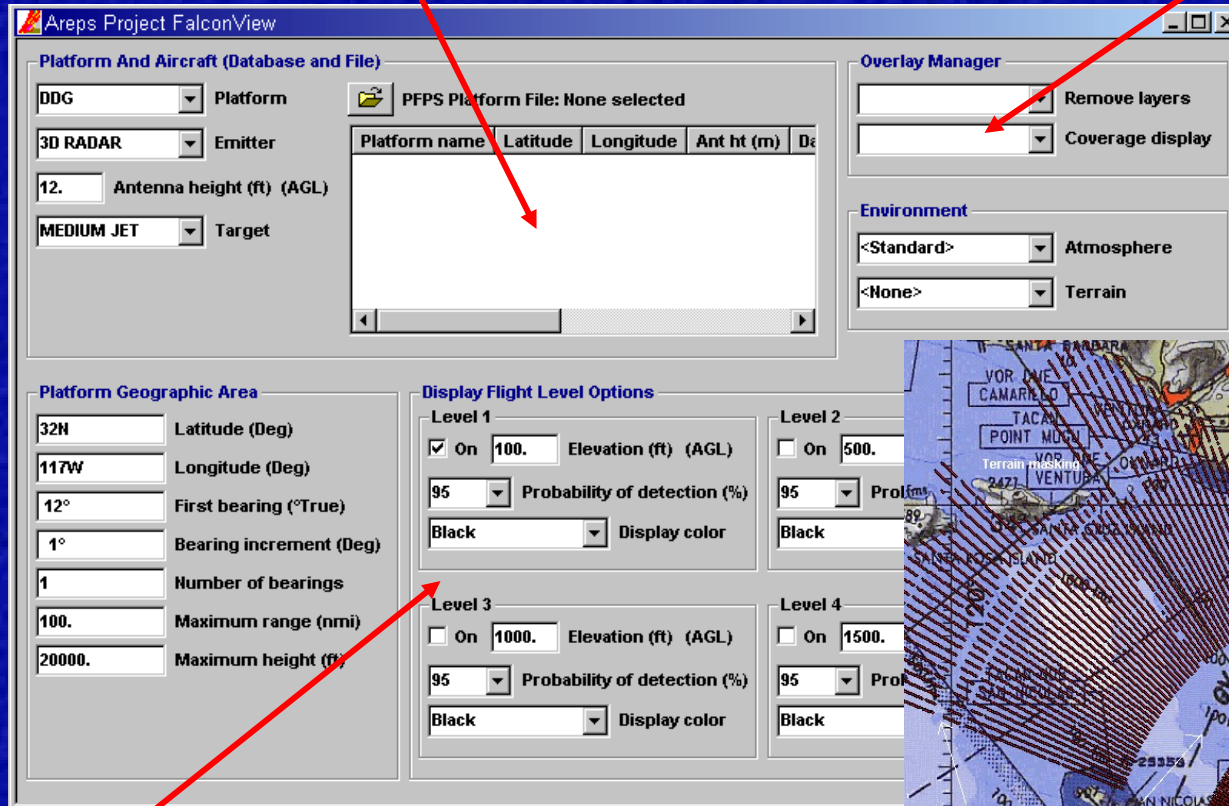
- Run multiple projects in batch “hands-off” process

# FalconView Overlay

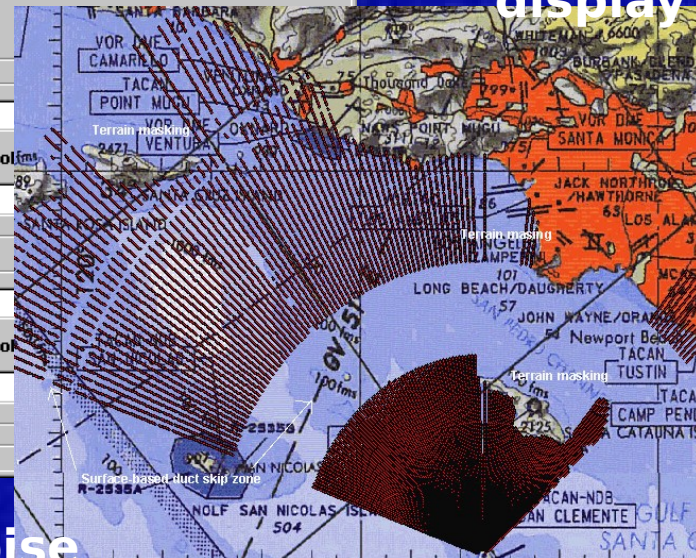
Window

Import various EOB files

All normal  
AREPS  
displays



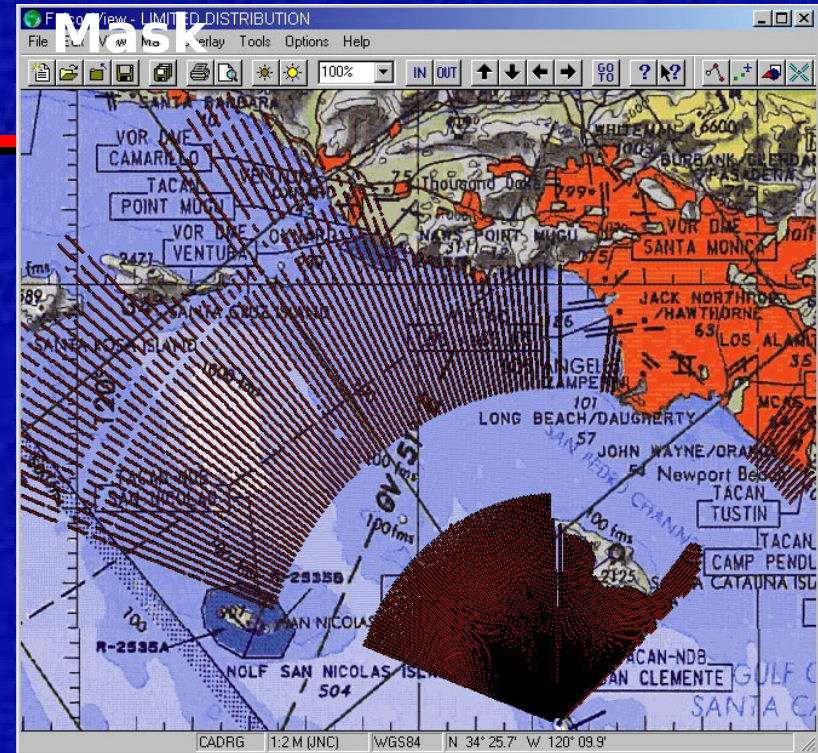
FalconView  
display



4 levels of radar POD or signal-to-noise

## PFPS 3.1.2 Threat Detection Mask

## AREPS Threat Detection Mask



### Considerations

- Single number detection range
- Entered by operator or in threat file

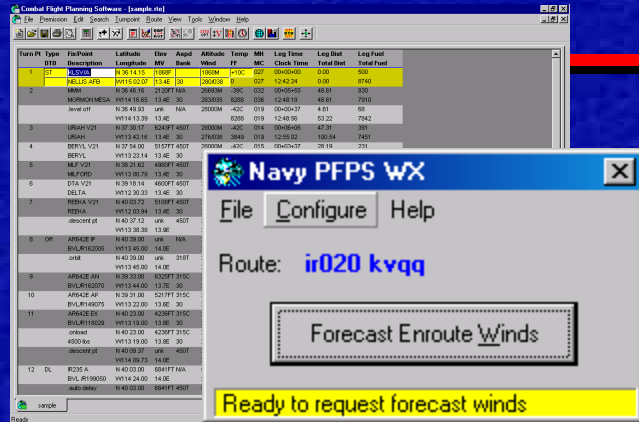
### Considerations

- Range/bearing/height variable atmosphere observed or forecast from numerical weather models
- Range/bearing terrain effects (DTED level 0, 1, or 2)
- System parameters of threat radar



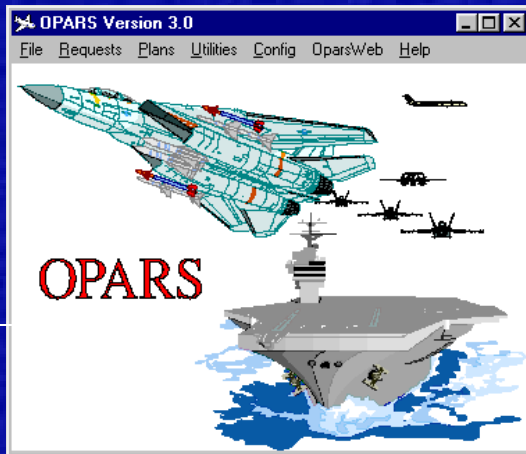
# N-PFPS

# TODAY



1. Open **N-PFPS** Interface
2. Build and Calculate Route
3. Open **N-PFPSWx** to Wind Route
4. **N-PFPSWx** accesses **OPARS** Data Server
5. Automatically enters Wind and Temp date into **N-PFPS** Route
6. Manual **OPARS** to **CRD** to **N-PFPS**

## Automated Interface OPARS



## NFWB



## FUTURE

1. Open **N-PFPS** Interface
2. Choice of building route and/or Optimize Route calling **OPARS**
3. Open **N-PFPSWx** to Wind Route, import Optimized Route from OPARS Data Server
4. Access **NFWB** for DD 175-1



# **OPARS Development Efforts**

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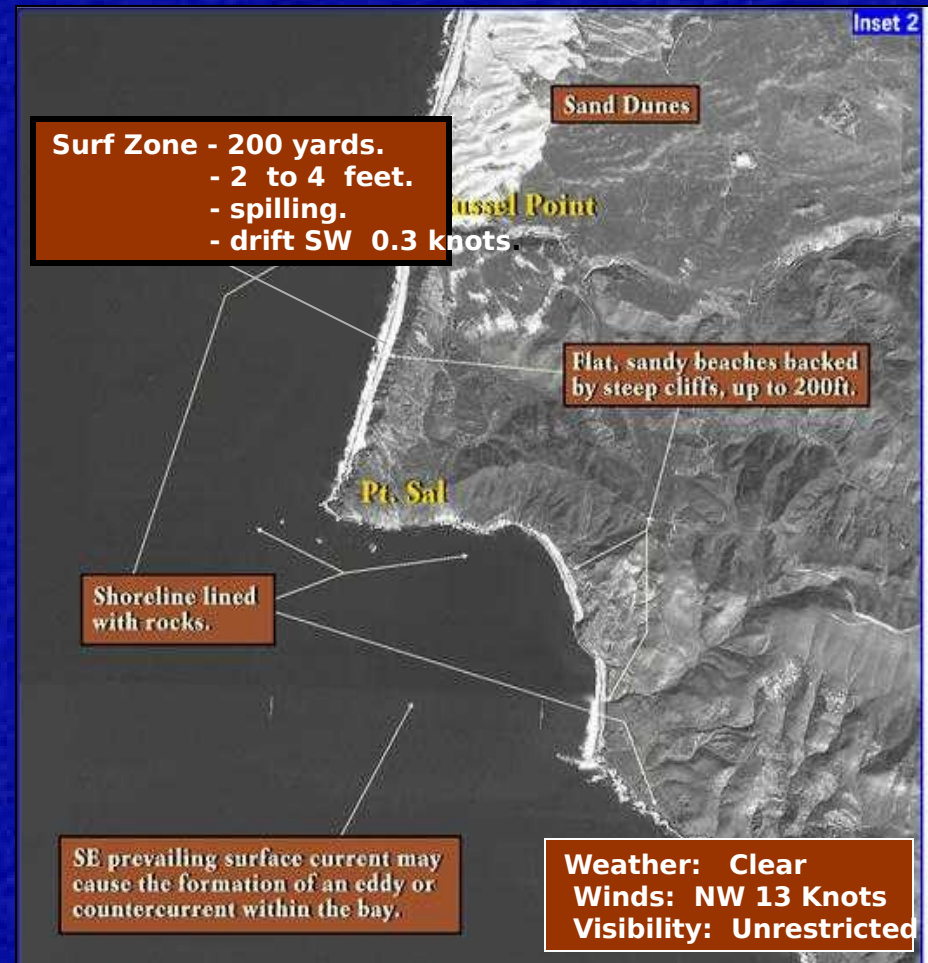
- ◆ **Implementation of OPARS as a Web Service**
- ◆ **Development of Interfaces between N-PFPS, OPARS and NFWB**
- ◆ **Use of N-PFPS FPMs by OPARS**
- ◆ **Expanded use of available Weather data**

# Target Area METOC TAM - Surf Hawk

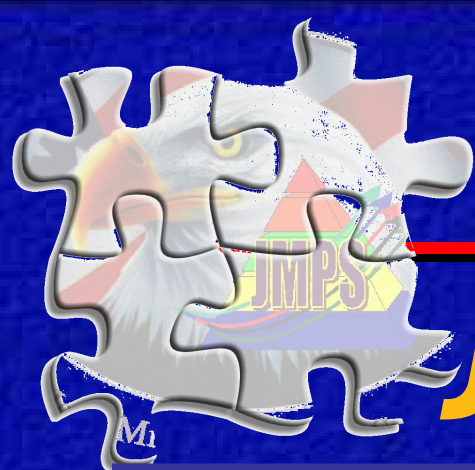
◆ Developmental concept based on non-traditional uses of National Technical Means for METOC support to warfighter.

◆ Potential exists to retrieve:

- Wind speed and direction
- Cloud types, heights/bases
- Visibility
- Wave height and direction



\* Landsat used for illustration only




# **Future METOC**

## ***JMPS Post JC-1***

- ◆ **Sensor predictions & Wx / Env planning ID'd as post JC1 are funded Common Capability Requirements (CCR)**
- ◆ **Seamless SA and mission / platform specific METOC impacts... "Wx Button"**
- ◆ **Targeted system for Navy / USAF C4ISR METOC Interoperability**
- ◆ **GOAL:** Geospatially Enabled METOC products that are in your decision-making loop

# Questions?

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**Thanks to the many contributors to this brief: TAWS: Dr Goroch, Mrs. Gouveia, Mr Young; AREPS: Mr Paterson; OPARS: Mrs Estrada; TAM: Mr Little; JMPS: LCDR Raglin**